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Final Project – Modeling Interval Temporal Dependencies for Complex Activities Understanding

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14. ABSTRACT
Complex activity typically consists of temporally sequential or overlapping primitive events occurring over a time interval. The existing dynamic models are point-based and they cannot effectively model event temporal dependences. To overcome this limitation, we introduce the Interval Temporal Bayesian Network (ITBN), a novel graphical model that combines the Bayesian Network with the Interval Algebra, to explicitly model the temporal dependencies over time intervals. Furthermore, to handle the challenge with explicit primitive event detection and

15. SUBJECT TERMS
Human activity modeling and recognition, Bayesian Network, and Interval Algebra

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a. REPORT	b. ABSTRACT	c. THIS PAGE			Qiang Ji
UU	UU	UU	UU		19b. TELEPHONE NUMBER 518-276-6440

Report Title

Final Project – Modeling Interval Temporal Dependencies for Complex Activities Understanding

ABSTRACT

Complex activity typically consists of temporally sequential or overlapping primitive events occurring over a time interval. The existing dynamic models are point-based and they cannot effectively model event temporal dependences. To overcome this limitation, we introduce the Interval Temporal Bayesian Network (ITBN), a novel graphical model that combines the Bayesian Network with the Interval Algebra, to explicitly model the temporal dependencies over time intervals. Furthermore, to handle the challenge with explicit primitive event detection and tracking in real world videos, we propose to use topic models to perform implicit event detection. Combining ITBN model with the topic models yields a powerful framework that can perform complex activity recognition without explicit primitive event detection and tracking. The proposed framework is evaluated on two computer vision applications: human body activity recognition and human facial activity recognition.

Enter List of papers submitted or published that acknowledge ARO support from the start of the project to the date of this printing. List the papers, including journal references, in the following categories:

(a) Papers published in peer-reviewed journals (N/A for none)

Received	Paper

TOTAL:

Number of Papers published in peer-reviewed journals:

(b) Papers published in non-peer-reviewed journals (N/A for none)

Received	Paper

TOTAL:

Number of Papers published in non peer-reviewed journals:

(c) Presentations

Number of Presentations: 0.00

Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received	Paper

TOTAL:

Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received		Paper
10/10/2013	2.00	Ziheng Wang, Shangfei Wang, Qiang Ji. Capturing Complex Spatio-Temporal Relations among Facial Muscles for Facial Expression Recognition, IEEE Conference on Computer Vision and Pattern Recognition. 2013/06/20 00:00:00, . : ,
TOTAL:	**1**	

Number of Peer-Reviewed Conference Proceeding publications (other than abstracts):

(d) Manuscripts

Received		Paper
10/10/2013	1.00	Yongmian Zhang, Yifan Zhang, Eran Swears, Natalia Larios, Ziheng Wang, Qiang Ji. Modeling Temporal Interactions with Interval Temporal Bayesian Networks for Complex Activity Recognition, IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, (03 2012)
TOTAL:	**1**	

Number of Manuscripts:

Books

Received	Paper

TOTAL:

Patents Submitted

Patents Awarded

Awards

The PI was elected to a fellow of the International Association of Pattern Recognition, 2012

Graduate Students

NAME	PERCENT_SUPPORTED	Discipline
Ziheng Wang	1.00	
FTE Equivalent:	**1.00**	
Total Number:	**1**	

Names of Post Doctorates

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Names of Faculty Supported

NAME	PERCENT_SUPPORTED	National Academy Member
Qiang Ji	0.10	
FTE Equivalent:	**0.10**	
Total Number:	**1**	

Names of Under Graduate students supported

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Student Metrics

This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period:	0.00
The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:.....	0.00
The number of undergraduates funded by your agreement who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields:.....	0.00
Number of graduating undergraduates who achieved a 3.5 GPA to 4.0 (4.0 max scale):	0.00
Number of graduating undergraduates funded by a DoD funded Center of Excellence grant for Education, Research and Engineering:	0.00
The number of undergraduates funded by your agreement who graduated during this period and intend to work for the Department of Defense	0.00
The number of undergraduates funded by your agreement who graduated during this period and will receive scholarships or fellowships for further studies in science, mathematics, engineering or technology fields:	0.00

Names of Personnel receiving masters degrees

NAME

Total Number:

Names of personnel receiving PHDs

NAME

Total Number:

Names of other research staff

NAME PERCENT_SUPPORTED

FTE Equivalent:

Total Number:

Sub Contractors (DD882)

Inventions (DD882)

Scientific Progress

Through this project, our accomplishments can be summarized as follows

1) we developed and the implemented the proposed Interval Temporal Bayesian Network (ITBN) to model and capture complex spatiotemporal relationships among primitive events.

2)We further implemented a topic model to perform implicit primitive event detection and tracking, and integrated the topic model with the ITBN model to perform complex activity recognition without explicit event detection and tracking.

3) We demonstrated the integrated model for two computer vision applications:
human activity recognition and facial activity recognition. The results demonstrate the superior performance of the proposed framework to the existing dynamic models.

4) We published the results from this research in top computer vision journal (IEEE PAMI)and conference (IEEE CVPR).

Technology Transfer